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SPONDYLARTHROPATHIES IN AVAR AGE HUMAN REMAINS

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Abstract

During a paleopathological examination aiming at the research of articular diseases, 518 human skeleton remains belonging to the Székkutas-Kápolnadűlő cemetery (Hungary, territory east of the river Tisza) of late Avar and Sarmatian period have been analysed. We have found traces of spinal diseases in 116 (31.3%) cases out of 371 adult skeletons. In the majority of cases (109) we have registred osteochondrosis vertebrae, spondylosis deformans and spondylarthrosis. In two cases, signs of seronegative spondarthritis have been detected. We have assumed that among the infectious lesions vertebral tuberculosis have been found on two skeletons. The occurrence of DISH seems to be revealed in four cases. The definition of help of the illnesses has been carried out by the morphological and radiological method.

Key words: paleopathology, Avar period, arthropathies.

Introduction

During the evolution the human spine has suffered significant changes. The extent of its mechanical load and its function have undergone important modifications due to the longitudinal supporting rote of the vertebral column. The main difference compared to animals can be found in the sacro-iliac joint and the lumbo-sacral transition. From a phylogenetical point of view, the human spine is far less developed than the limbs showing significant differentiation. That is what explains the numerous variations and the susceptibility to diseases (OLÁH, 1987).

The aim of the present research program is to define and to diagnose spinal diseases of a human population of a historical age. The survey is part of the program relating to the anthropological and paleopathological examination of skeleton remains of the Székkutas-Kápolnadűlő cemetery of late Aver (8th century) and Sarmatian period and an overall 3-year research program entitled "Articular lesions in historical anthropological series".

Materials and methods

The 555 graves of the Székkutas-Kápolnadűlő cemetery of late Avar and Sarmatian period were uncovered between 1965 and 1986 under the direction of KATALIN NAGY archeologist of the Tornyai János Museum of Hódmezővásárhely (NAGY, 1982). The subject of the anthropological and paleopathological analysis consisted of 518 human skeletal remains (the greater part of which being uncomplete) uncovered from 555 graves.

The determination of sex and age at death carried out with traditional methods used in historical anthropology (FARKAS, 1972; LIPTÁK, 1980; MARTIN and KNUSSMANN, 1988). In the case of adult skeleton remains we managed to carry out the age estimation with an accuracy of 10 years. The skeleton remains have classified follows: group Inf I.:54 (10.4%), Inf II.:52 (10.1%), Juv.:41 (7.9%) and 371 adult skeletons (71.6%) for latter, see details in Table I.

During the macroscopic morphological examination of spinal lesions, we have analized the remains of 371 adult skeletons of the Avar period – as we have not found any lesion on infant and juvenile skeletons previously. For more problematic cases, particularly for complicated differential diagnose, we had to apply X-ray analyses. On skeletons showing the signs of osteoporosis, the extent of the disease has been determined by using the Barnett-Nordin biconcavity index (OLÁH, 1987).

Discussion

The description of spinal diseases can be found in most of the general paleopathological studies, from the early period of paleopathology to nowadays (PALES, 1930; WELLS, 1964; DUTOUR et al., 1989). However, the interpretation of these works meets some difficulties. Cases described some 20-25 years ago as ankylosing spondylitis would probably be considered today as ISH (ORTNER, 1988). Not only the existing and the historical populations or our prehistorical ancestors, but also a great number of the different vertebrates (e.g. the Dinosaurus) suffered from spinal diseases (PALES, 1930).

During the paleopathological diagnosis of the arthropathies – and among them the diagnosis of spinal diseases – the main task is to define the nature of the morphological changes (erosive, proliferative), the pattern of dispersion, other pathological features, the sex and age of the skeleton. The next step is the radiological analysis of the remains, which helps to make comparison between the fossil material and the clinical cases (ROGERS et al., 1987; and ROGERS's personal comment). During the examination, we intended to carry out the diagnostics and the classification of the spondylarthropathies taking into consideration the above mentionned criteria.

1. DEGENERATIVE SPINE DISEASES

The degenerative lesions of the spine is as frequent as the arthrosis deformans of the joints. The degeneration takes place in the course of the senescence or due to

other metabolic effects. The degeneration takes place under a continous mechanical microtraumatisation of the vertebral disc that results in osteological consequences (KORONDI and ZAHUMENSZKY, 1988; GÖMÖR and BÁLINT, 1989; GREGG and GREGG, 1987.)

Out of the 371 adult skeleton remains of Székkutas, 109 showed sings of degenerative spinal disease. For breakdown by sex and age: see Table I. It shows clearly that the lesions become more frequent with the growth of age, and as to the breakdown of sexes, males are predominant.

Table I.: Breakdown by sex age at death of the remains
H: healthy
D: diseased (remains showing degenerative spine diseases)
N: total number of adult skeletons (371)

Sex / Age at death	Male		Female		Undet. sex		Total n		Total N%		Diseased (%) in the ratio of age groups
	H	D	H	D	H	D	H	D	H	D	
20-30	12	5	37	2	4	-	53	7	14.3	1.9	13.2
30-40	51	15	48	17	3	-	102	32	27.5	8.6	31.4
40-50	49	25	39	7	4	-	92	32	24.7	8.6	34.7
50-60	35	17	25	7	2	1	62	25	16.7	6.7	40.2
60-	12	8	12	4	8	1	32	13	8.6	3.5	40.7
Undet. age	6	-	5	-	19	-	30	-	8.2	-	-
Total	165	70	166	37	40	2	371	109	100.0	29.3	-
Sex rate(%)	44.5	44.7	10.8	100.0							

There have been many attempts to determine the types of degenerative lesions according to their stadium. The 5-grade classification of CHAPMAN (1972) does not enable us to classify the degenerative changes and other proliferative alterations of the spine, and we consider it rather artificial.

According to the present pathological and radiological knowledge the degenerative lesions of the spine can be classified in three groups:

- *Osteochondrosis vertebrae* (Fig.1.): The pathological changes effect not only the discus but also the subcondral bone which can result the sclerosis of the surface of the vertebral body. Degenerated nucleus pulposus often changes place: Schmorl-hernia can be produced.

- *Spondylosis deformans* (Fig.2.): Proliferative bone changes can be seen at the margins of the vertebral bodies (spondylophyte). Fibrocartilage at the rim of the joint ossifies and becomes contigous with the joint margin.

- *Spondylarthrosis*: Intervertebral joints are also affected by the degenerative changes (OLÁH, 1987).

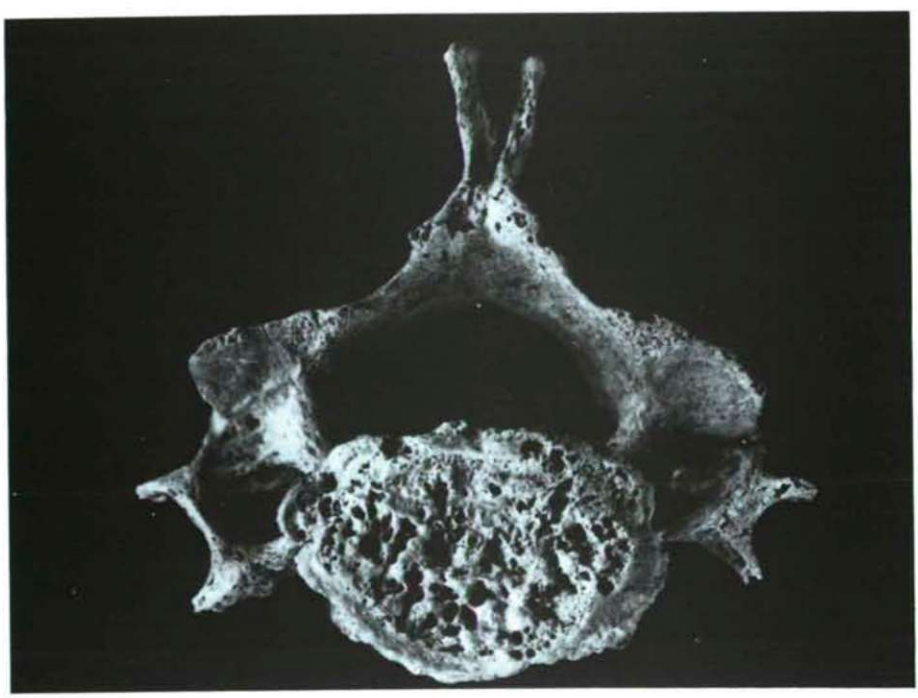

Fig.1. Osteochondrosis vertebrae on a cervical vertebra. Finding Nr. 8840, grave Nr. 326. Male, 60- years of age

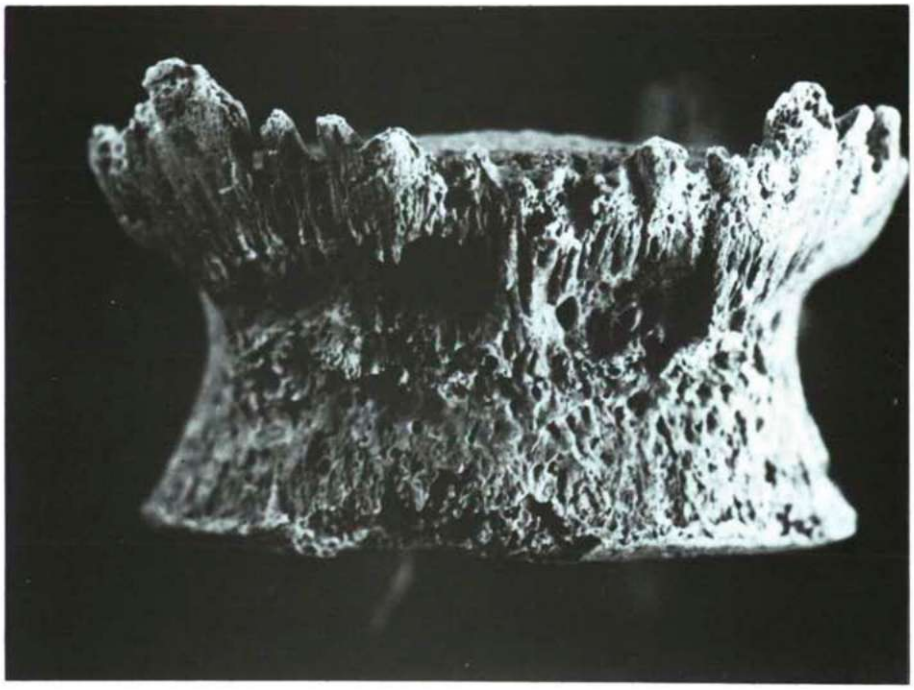

Fig.2. Spondylosis deformans on a lumbal vertebra. Finding Nr. 8870, grave Nr. 356. Male, 40-50 years of age

We have carried out examinations on 109 skeletons showing degenerative spine disease in order to determine the predilectic regions. Instead of the expected 2725 vertebrae we were obliged work with only 1617 (58.5%) and instead of the 109 sacrum 86 (78.9%) were available. 669 vertebrae (42.3%) and 44 sacrums (51.1%) belonging to these skeletons have been affected by more or less serious alteration.

We can state on the basis of the data that the degenerative disease is a general process affecting a great number of vertebrae. As the three above mentioned categories are based on quantitative (consequently chronological) differences (rather than on aetiological ones), it is quite understand that often we have found examples of each categories on the different spinal regions of one skeleton.

46 skeletons showed osteochondrosis vertebrae, and 20 out of them with traces of Schmorl-hernia. While this type of lesion was more frequent on the thoracic vertebrae, more serious spondylosis or spondylarthrosis has developed on the lumbal and lumbo-sacral region.

In some of the cases, the prearthrosis-factor causing secondary degenerative lesion could have been identified:

- *spondylolysis:* 3 cases (*spondylarthrosis*);
- *sacralisatio*: 5 cases (*spondylarthrosis*, *sacro-iliitis* in 2 cases);
- *luxatio coxae congenita*: 1 case (*spondylosis* def.);
- *scoliosis*: 1 case (*spondylosis deformans*).

We have found two cases of spondylarthrosis with serious ankylosis:

- 1st case: female skeleton, 40-50 years of age (finding Nr. 11553, grave Nr. 292): serious spondylarthrosis on the vertebrae C4-C7. Ankylosis of the vertebral bodies of C6-C7;
- 2nd case: male skeleton, 40-50 years of age (finding Nr. 8912, grave Nr. 399): spondylarthrosis on the C5-C7, T8-T12, L1-L5 spinal segments. Ankylosis of the vertebral bodies and the intervertebral joints of C5-C6.

2. SERONEGATIVE SPONDYLARTHROPATHIES

The seronegative spondylarthropathies (SNSA) is a collective term initiated in the rheumatological nomenclature during the last decade. The most important diseases belonging to SNSA are the ankylosing spondylitis, psoriatic arthropathy, enteropathic arthropathies and reactive (postinfectious) arthritises (e.g. Reiter's syndrome). Lesions have been detected not only on recent and historical human populations (KRAMAR, 1980; HORVÁTH and FORGÁCS, 1984; ROGERS et al., 1987) but also on remains of Primates (LOVELL, 1990).

There are two cases out of the series where we seem to have found seronegative spondylarthropathie. The exact definition of the diseases was not possible because of fragmentary material, lack of clinical symptoms and the possible differences of symptoms between individual cases (GÖMÖR and BÁLINT, 1989).

- 1st case: male skeleton, 40-50 years of age (finding Nr. 5791, grave Nr. 67) fragmentary skull and skeleton. Pathological alterations: Bywaters-Dixon type syndesmophytes between L3-S1, ankylosis of L4-L5. Small joints are also affected (Figs.3-4.);

T4-T12: arthritis in the small joints with decreasing intensity upwords; C5-C6: small joints affected by arthritis; Slight proliferative sacro-iliitis on the right side; Erosive arthritis on the atlanto-occipital, left shoulder and right sternoclavicular joints;

Erosive-proliferative changes of MTP and PIP joints; Several tarso-matatarsal ankylosis;

Bilateral proliferative changes of hip and knee joints; Ossification of entheses on both ulna and hip bone.

The presence of syndesmophytes and the ankylosis between vertebral bodies, the erosive-proliferative arthritises and ossification of entheses, the ankylotic

symptoms of tarso-metatarsal joints led us to assume the occurrence of SNSA (ROGERS, 1988; GÖMÖR and BÁLINT, 1989).

Fig.3. Seronegative spondylarthropathie. Finding Nr. 5791, grave Nr. 67. Male, 40-50 years of age

– 2nd case: male skeleton, 30-40 years of age (finding Nr. 5802, grave Nr. 80), fragmentary skull and skeleton. Pathological alterations: complete ankylosis of 4 (Fig.5.) and 2 other thoracic vertebrae in the intervertebral joints. Syndesmophytes on the fragments of vertebral bodies. The ossification of the costovertebral joints and ligaments can be seen on the radiograph (Fig.6.).

The bodies of the lumbal vertebrae cannot be evaluated; but an extensive osteopytosis of the posterior joints was observed.

Slight bilateral sacro-iliitis and proliferative changes of the right carpo-metacarpal joint are present.

On the fragmentary remain we could not carry out a satisfactory differential diagnose. On the basis of the above mentioned criteria we consider that the case belongs to the SNSA group (ROGERS and WALDRON, 1986).

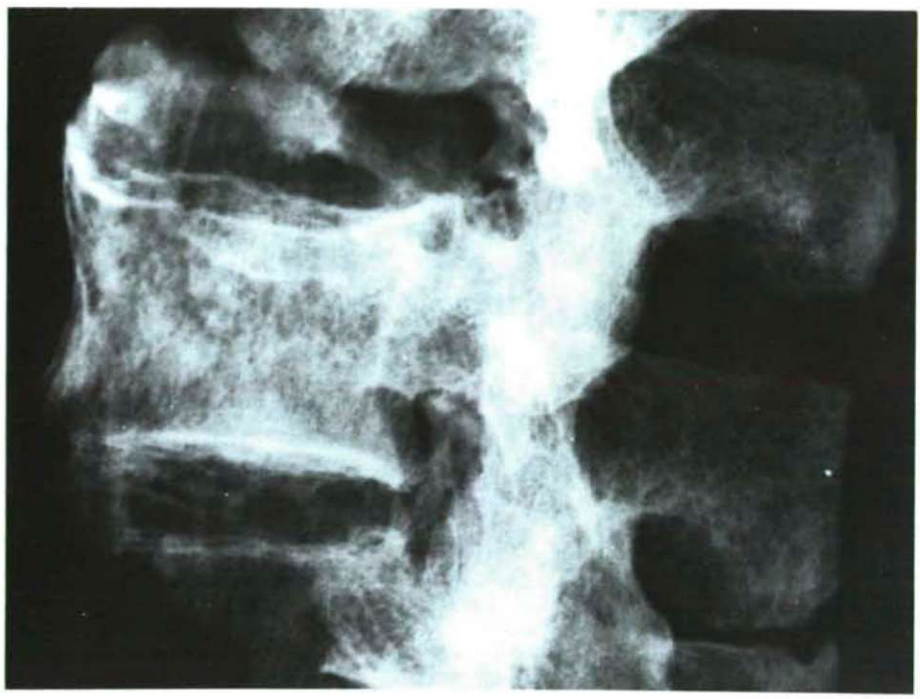

Fig.4. Radiograph of the vertebrae seen on Fig.3. Finding Nr. 5791, grave Nr. 67. Male, 40-50 years of age

3. INFECTIOUS SPONDYLARTHRITISES

This group involves cases with joint inflammation caused by microorganisms. Osteomyelitis is the result of introduction of pyogenic bacteria into vertebrae by hematogen dissemination or by direct affection. It causes pain and fever, and the recovery goes together with a massive ossification and fast ankylosis (BENDER, 1987).

Vertebral tuberculosis is an extrapulmonal form of the postprimer tuberculosis. The pathological process caused by the *Mycobacterium tuberculosis* or *M. bovis* is spreading from the primary center of infection to the bones with hematogen dissemination (BÉLÁDI et al., 1987). The tuberculous process erodes the cortical surface and slowly extends into the anterior portion of the vertebral bodies. Collapse of one or several vertebral bodies with remaining vertebral arches and spinous processes leads to a sharply angular gibbus (POTT's disease) (ENDES, 1983; BARTA, 1986).

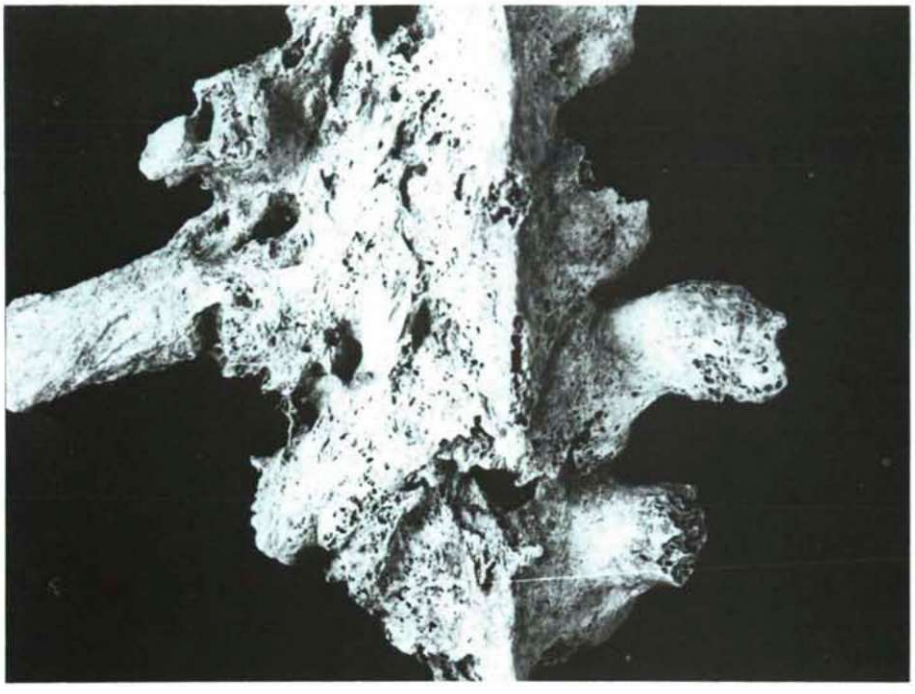

Fig.5. Ankylosis of thoracic vertebrae. Finding Nr. 5802, grave Nr. 80. Male, 30-40 years of age

The paleopathological description of the symptoms of the tuberculose is know from the beginning of the century mainly due to the activity of MOODIE (in: JANSSENS, 1970).

Presumably we have found spondylitis tuberculosa in two cases. Their more detailed description is as follows:

– 1st case: male skeleton, 40-50 years of age (finding Nr. 5784, grave Nr. 60). Formation of POTT-gibbus between T10-L1 with atrophy of the vertebral bodies; fusion of T11-T12.

– 2nd case: female skeleton, 30-40 years of age (finding Nr. 8857, grave Nr. 343). Sharply angular kyphosis between T4-T8 with attenuation and destruction of vertebral bodies; ankylosis of T5-T6. (This case is very similar to the tuberculous symptoms of the remain (Nr. NMIC28680-715) described by BENNIKE (1985).

The common characteristics of the two cases are that the tuberculous spondylitis involved vertebral bodies in the thoracic spine and healed with gibbus without massive new-bone formation.

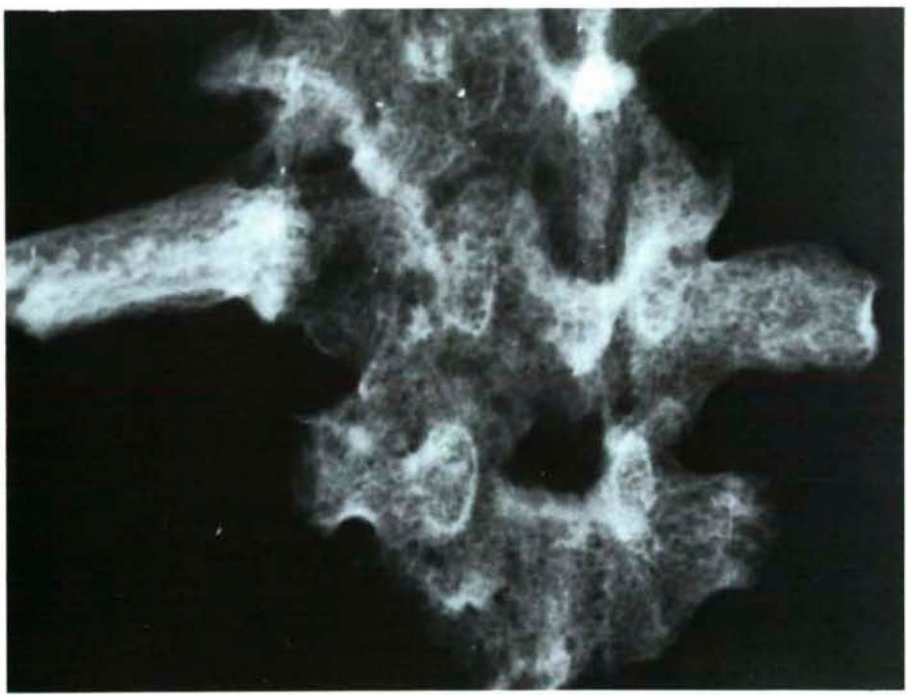

Fig.6. Radiograph of the vertebrae seen on Fig.5. Finding Nr. 5802, grave Nr. 80. Male, 30-40 years of age

4. DIFFUSE IDIOPATHIC SKELETAL HYPEROSTOSIS (DISH)

The disease is characterised by the regional ossification of the anterior longitudinal ligament and by the extraspinal manifestations of new bone growth in ligaments, in tendinous insertions or in cartilage. Common sites include the linea aspera, olecranon, iliac crest, ischial tuberosity, trochanters, patella and calcaneum. The ossification of the costal and laryngeal cartilages is also possible (ROGERS, 1982).

According to some authors (BENDER, 1987; KORONDI and ZAHUMENSZKI, 1988) the DISH is quite common among males of today's population (over 50 years of age). In classic DISH the vertebral bodies may be ankylosed, but the disc spaces are normal and the facet joints – in the absence of other pathology – are almost always normal.

The first typical example of the disease in skeletal material has been described by ROGERS in 1980 and it can be found rarely in the paleopathological literature

(BRUINTJES, 1988). This can be explained by the fact its differentialdiagnose is a rather problematic field (MORLOCK, 1986).

During the examination of our Avar age remains, we have not met classical, serious cases. In four cases, we have found lesions of lighter stadium:

– 1st case: male skeleton, 30-40 years of age (finding Nr. 5824, grave Nr. 102). Ossification of costal cartilages and the insertions of the Achilles tendom into the calcaneum. Early hyperostosis between T10-L3. Early DISH is possible.

– 2nd case: male skeleton, 50-60 years of age (finding Nr. 8289, grave Nr. 155). Ossification of costal cartilages and several entheses (lig. patellae, lig. interosseae metatarseae, tendo calcanei). Slight hyperostosis between T3-T10. Slight DISH.

– 3rd case: female skeleton, 50-60 years of age (finding Nr. 8348, grave Nr. 220). Ossification of costal cartilages, hyperostotic changes on the surface of the arch and symphysis pubic, hyperostosis between T1-T6, ankylosis of C6-C7. Medium stage of DISH.

– 4th case: male skeleton, 40-50 year of age (finding Nr. 9543, grave Nr. 482). Slight hyperostosis between T4-T12, incipient ossification of ligaments. Calcaneal spurring, massive new bone formation on the surface of the patella, symphysis pubic, iliac crests, ischial tuberosities. Medium stage of DISH is possible.

The aetiology of DISH is not clarified at present, it is always considered to be the side effect of diabetes mellitus (FORGÁCS, 1982; KORONDI and ZAHUMENSZKY, 1988).

Conclusions

During the morpho-pathological examination of the human skeleton remains belonging to the Székkutas-Kápolnadűlő cemetery of late Avar period, we have come to the following conclusions:

1. *The composition of the population:* During the determination of sexes and ages at death it has been revealed that the number of skeletons belonging to the groups Inf.I. and Inf.II. is smaller than the values of similar archeological periods. This is explained by the great extent of fragmentary skeletons of infant remains – it is very possible that only few of them are still for archeological purposes after 1200 years.

Within the adult population, the extent of deseases of young women can probably be explained by the greater extent of mortality at childbirth of that time.

2. *Spondylarthropathies:* No lesions have been detected on infant and juvenile skeletons. As to the adult remains, the pathological cases of the spinal joints are more frequent than the diseases of the other part of the skeleton, all together.

Out of 116 rheumatic spinal lesions, we have found lumbal vertebrae suitable for measurement in 87 cases, therefore we have defined the biconcavity factor on the

basis of these. In 37 cases (42.5%) the value of the calculation was less than 80%, which is considered pathological by the rheumatological literature (OLÁH, 1987; GÖMÖR and BÁLINT, 1989). It is worth mentioning that the osteoporosis and the spinal lesion are so strongly associated.

The degenerative spinal lesions are the most frequent pathological lesions. 109 cases represent 29.3% of the adult population. This is similar to the values of other series of the Avar period, and there is no significant difference compared to the results of the wide-spectrum swiss neolithic and medieval series (KRAMAR et al., 1987). During the classification of the degenerative spinal lesions, our intention was to eliminate the weaknesses of the previous methods. Although, the fact that we have found explicit arthrosis of the small joints without any sign of osteochondrosis or spondylosis deformans, seems to demonstrate that the two processes are not necessarily developing parallely with each other. The different degenerative pathomechanism of the hyaline-cartilaginous (diarthrodial) and fibrocartilaginous intervertebral joints are already mentioned in the literature (LOTT et al., 1987).

The fact that males are more frequently affected emphasises the role of the mechanical factors in the course of the process.

Less frequent spinal lesions – vertebral tuberculosis, SNSA group, DISH – are not suitable for statistical analysis due to their low frequency. Their frequency is satisfactory in the case of seronegative spondylarthropathies (KIRWAN, 1988) and vertebral tuberculosis (GLADYKOWSKA-RZECZYCKA, 1982) showing similarity with the data of the literature, but the frequency of DISH in inferior (MORLOCK, 1986). Beside the fact that we deal with fragmentary material, the reason of the above mentioned problem is that early stage and atypical cases cannot be separeted from more general spinal lesions.

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